Management of High Performance Computing (HPC) Resources Within the Weather Program Office's Supplemental Appropriations Program to Improve Predictions of Extreme Weather Events

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NOAA WEATHER PROGRAM OFFICE

Supplemental HPC Requirements

The availability and access to sufficient HPC is imperative to the success of a number Supplemental projects. Many of the projects in the FY18 and FY19 portfolios have wrapped up in the last year. These projects primarily leveraged HPC through existing NOAA resources.

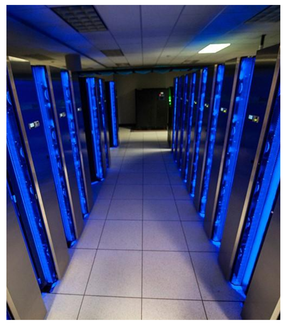
- The FY18/19 portfolios required ~65M core hours/month
- DRSA allocated $50M for improvements to operational and research weather & climate supercomputing dissemination infrastructure
  - 85M core hours/month and 9,250 TB of storage are required for DRSA projects
  - Cloud resources are increasingly being leveraged by DRSA projects

Dogwood supercomputer (Manassas, VA)
Credit: General Dynamics Information Technology (GDIT)

HPC Mitigation Strategies

There is currently an HPC gap of approximately 20M core hours/month between FY18/19 requirements and DRSA requirements. The Supplemental team works closely with the HPC Allocation Committee, HPC portfolio managers, and PMs to mitigate potential impacts of limited HPC availability and access.

- Mitigation strategies include:
  - Staggering project schedules if necessary
  - Encouraging PMs to leverage cloud resources whenever possible
  - The team has helped serve as a liaison between PMs and software engineering support to help maximize utilization of all resources (on prem and cloud)
- An early success story includes the Hurricane Analysis and Forecast System (HAFS) team leveraging AWS Cloud to run the HAFS Ensemble during the 2023 hurricane season



Orion Supercomputer stack housed at Mississippi State Uni.

Weather Program Office Supplemental Appropriations Program

The Mission

The Supplemental Appropriations Program team provides cross line office coordination, monitoring, reporting, and communications of congressionally directed research activities intended to improve forecasting and prediction capabilities in response to significant weather events and natural disasters.

The Supplemental Portfolios

The Supplemental Program manages 4 portfolios that include 75 projects. 29 projects across the FY18, FY19, and DRSA portfolios have leveraged HPC resources for research to improve predictions of extreme weather events. The Supplemental Appropriations Portfolios include:

- Improving Forecasting and Assimilation (FY18): **Weather Forecasting Hurricanes Floods Data Assimilation**
- Improving Forecasting of Hurricanes, Floods, & Wildfires (FY19): **Hurricanes Floods Wildfires**
- Disaster Relief Supplemental Appropriations Act of 2022 (DRSA): **Hurricanes Wildfires Extreme Precipitation & Floods**
- Bipartisan Infrastructure Law Provision 3 (BIL): **Service Delivery/Social, Behavioral, & Economic Sciences**

Program Team Duties

Coordination

- Coordinate HPC requirements and match projects with appropriate HPC needs, including cloud and data storage
- Work closely with the HPC portfolio manager(s) & Allocation Committee; advocate for Supplemental HPC needs

Monitoring

- Monitor and track HPC resources including capacity and usage
- HPC resource availability serves as one of the largest risks to Supplemental projects

Reporting

- Report HPC Risks & Issues to NOAA leadership on a quarterly basis
- Work with HPC Allocation Committee and HPC portfolio manager(s) to mitigate HPC Risks & Issues

Communication

- Serve as a liaison between project managers, the HPC Allocation Committee, and portfolio manager(s)
- Utilize DRSA monthly newsletters to communicate pertinent HPC information to PMs

Supplemental Program HPC Management Structure

FY18/19 resources were spread across 6 HPC portfolios with 6 different portfolio managers. This presented various challenges, including monitoring and tracking.

- DRSA will have its own dedicated portfolio and portfolio manager
  - This will help streamline tracking of HPC utilization and communication of portfolio risks, issues, and needs
  - The Supplemental team will support the DRSA portfolio manager, who will serve as the point of contact to the HPC Allocation Committee

Credit: Oak Ridge National Laboratory

Supplemental Appropriations Success

Supplemental HPC resources have been instrumental in advancing applications in the Unified Forecast System.

- Advancements to the Hurricane Analysis and Forecast System (HAFS)
  - Improved accuracy of hurricane track and intensity
  - HAFS v1 transitioned into operations in Summer 2023
  - Moving Nests version of HAFS nearing completion
- Improved wildfire prediction, detection, & forecasting and air quality forecasts
  - Improved biomass burning emission modules in the Rapid Refresh Forecast System (RRFS) and the RRFS-Community Multiscale Air Quality Model

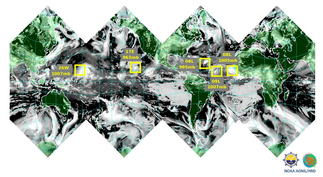


Image credit: Bill Ramstrom, NOAA/AOML/HRD (CIMAS)

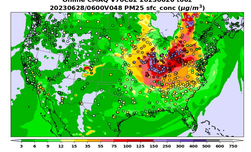


Image credit: Ivanka Stajner, NOAA/NWS/NCEP/EMC

Opportunities

Integrate cloud resources into the Supplemental Portfolios and maximize utilization of software engineer support

New systems coming online, such as Gaea C6, to help fill the DRSA HPC gap

Challenges

Providing sufficient assistance to all projects that want/need access to cloud resources

Matching new projects in DRSA with sufficient HPC resources, i.e., Extreme Precipitation projects

Additional Information

Scan the QR code to learn more about NOAA's Weather Program Office (WPO) and the Supplemental Appropriations Program.

Scan me!

Acknowledgements

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